

“Skin in the Game”: Zero Downpayment  
Mortgage Default

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Abstract

This paper extends the analysis of mortgage default to include mortgages that require no downpayment from the purchaser. The results indicate that borrowers who provide even modest downpayments from their own resources have substantially lower default propensities than do borrowers whose downpayments come from relatives, government agencies, or nonprofits. Borrowers with downpayments from seller-funded nonprofits, who make no downpayment at all, have the highest default rates. Eliminating FHA's 3% downpayment causes default to rise far beyond the simple effect of a 3% change in equity.

The idea that equity is important in the homeowner's decision to default is longstanding in the academic literature.<sup>1</sup> Estimates of the relationship between equity and default go at least as far back as Herzog and Earley (1970), and a firm theoretical underpinning for the decision to default was provided by Kau and Kim (1994). Equity comes in two flavors: initial equity in the form of the downpayment, and contemporaneous equity, which adds in price appreciation (or depreciation) post purchase, amortization, and sometimes changes in the market value of the mortgage balance. Research finds that contemporaneous equity has a strong influence on credit risk, and some papers, such as Harrison, Noordewier, and Yavas (2004) find that initial equity has a modest additional impact, over and above its effect on contemporaneous equity, perhaps because it reflects the household's ability to save, or because it is more precisely measured than accumulated equity.

In standard models of loan default, so-called “ruthless default,” such as Kau and Kim (1994), the source of the downpayment is irrelevant. If property value is sufficiently below the loan balance, the borrower defaults. But many empirical models, such as Capozza, Kazarian, and Thomson (1997) or Danis and Pennington-Cross (2005), have stressed the importance of “trigger events,” such as unemployment, illness, or divorce. These events may produce cash flow problems leading to diminished equity, as delinquent payments increase the loan balance. The delinquency and increased loan balance may result in eventual default. The source of downpayment has not previously been considered in default modeling, but the relationship between default and the source of the borrower's downpayment may be related to trigger events. Borrowers who are capable of increasing their savings, or increasing their labor earnings, in response to unforeseen events may be less susceptible to trigger events. The need to save for a downpayment may serve to separate those who can more readily increase saving and earnings from those who find it more difficult. Krumm and Kelly (1989) find that savings

and the transition to homeownership are endogenous, while Haurin, Wachter, and Hendershott (1995) find that the labor earnings of households often increase prior to entering homeownership. Both of these studies covered time periods in which zero down loans were generally unavailable.<sup>2</sup> The need to accumulate a downpayment may drive savings and earnings behavior, and eliminating the need to accumulate a downpayment may draw in others in less flexible circumstances.

Another reason that the source of downpayment may be important is the case of seller-funded nonprofits. Lenders and insurers generally limit the amount of assistance that sellers can provide to buyers, presumably because this assistance can make a round-trip. If the selling price is increased when seller-funded assistance is present, the seller gets back the money "given" to the buyer, in the form of a higher price. The collateral value, hence the LTV, is misstated to the lender's or insurer's detriment. Fannie Mae, Freddie Mac, and private mortgage insurers often limit the amount of closing cost assistance from sellers to 3% of the transaction price, and FHA limits the amount of seller assistance to 6%. However, since 1997 the FHA has allowed seller-funded nonprofits to donate funds to purchasers using FHA mortgages, and then bill the sellers for the amount of the donation plus a transaction fee.<sup>3</sup> This funding is not counted against the 6% limitation on seller provided funds, and may be used as the 3% cash required from the borrower.<sup>4</sup> HUD's OIG (Office of the Inspector General) (HUD, 2000, 2002) and GAO (2005b)<sup>5</sup> have found that sales prices of homes using seller-funded nonprofits are generally increased to reflect the seller-funded assistance.<sup>6</sup> If this assistance causes sellers to raise the price beyond the market clearing price based on arms' length transactions, the maximum allowable loan value increases.<sup>7</sup> The apparent equity in these transactions would not exist and they would be, in effect, nothing down mortgages, as the loan amount would cover the full cost of the transaction, price plus closing costs.

A handful of studies sponsored by HUD or by seller-funded nonprofits have examined the relationship between the source of downpayment and claim and delinquency rates. In the two HUD OIG studies cited above, 90-day delinquency rates were compared for FHA single-family loans originated in four MSAs: Indianapolis, Las Vegas, Sacramento, and Stockton, over the time period 1997-1999. About 2,000 loans that had received seller-funded assistance through the largest downpayment assistance program, Nehemiah, were compared to other FHA loans in these four cities. In the first study, examining delinquencies through 1999, assisted loans had double the delinquency rate of unassisted loans, while the second study examined delinquency on the same set of loans through February 2002, and also found seller-funded assistance doubled the delinquency rate. In response to these studies, a coalition of seller-funded nonprofits, the Homeownership Alliance of Nonprofit Downpayment Providers (HAND), commissioned a CPA firm to examine delinquency rates for FHA borrowers in states where seller-funded nonprofits were active, and compare delinquency rates for loans with nonprofit assistance to loans with other forms of downpayment assistance, such as gifts from relatives or government programs (Reznick, Fedder, and Silverman 2003). This study found elevated delinquency rates for all forms of assistance, and found that nonprofit assistance delinquency was comparable to delinquency rates of loans with assistance in other forms. Both the OIG studies and the HAND study fail to hold constant many important variables. For example, the OIG studies do not differentiate between loans with various loan-to-value ratios, and

use a data source that does not include the borrower's credit score. The HAND study does limit its sample to high LTV loans, but does not have credit scores and, more importantly, compares loans over different "default windows," the time between origination and the date on which delinquency is measured. Delinquency status (ever 90 days delinquent) as of May 2003 was examined for loans originated between 1997 and 2001. Since the use of seller-funded nonprofit assistance has grown rapidly, from less than 1% of FHA purchase loans in 1997 to about 10% of FHA purchase loans in 2001 (GAO, 2005b), the failure to control for the length of the default window means that the loans with seller-funded downpayment assistance had, on average, much shorter time to default than did the loans to which they were compared.

While the source of the downpayment has not generally been considered in academic studies of default, several studies have looked at the importance of downpayment assistance to homeownership. Linneman and Wachter (1989) first examined the extent to which households are downpayment constrained. Mayer and Engelheart (1996) document first time home buyer's growing reliance on gift assistance, often from relatives. However, none of these studies consider the effect of lowered downpayment constraints from conventional lenders, or the proliferation since 1997 of seller-funded downpayment assistance nonprofits. Herbert and Tsen (2005) consider the potential for downpayment assistance in the current environment. Two HUD sponsored studies of seller-funded nonprofits by the Concentrance Corporation document the substantial growth in gift assistance in the FHA portfolio, and summarize focus groups with borrowers, lenders, and real estate agents, who report higher prices, and higher delinquency and claim rates for loans with seller-funded assistance. The borrower focus groups staged by Concentrance also note confusion among borrowers as to the source of the assistance and the involvement of the seller and the nonprofit in the transaction.

The rest of the paper is laid out as follows. First, there is a discussion of the data and the trends in default and gift assistance. Second, the estimation strategy is described, along with the CTM software used to estimate the model. Third, there is a discussion of the results for 90-day delinquency, claims, prepayments, and loss given default. Finally, the paper closes with concluding remarks and some observations regarding policy.

## **Data**

### **Concentrance Sample**

The data for this paper consist of a nationally representative sample of just over 5,000 FHA single-family purchase money loans, endorsed between October 1, 1999 and September 30, 2002. These loans were drawn by Concentrance Corp, a HUD contractor, for a HUD-sponsored study of downpayment assistance.<sup>8</sup> This file is one of only two large random samples of seasoned FHA loans with FICO scores,<sup>9</sup> as HUD only began the routine collection of FICO scores as part of their Single Family Data Warehouse (SFDW) in 2004. In addition to FICO scores, the file contained many fields from the SFDW, such as the initial loan-to-value ratio as defined by FHA, the original mortgage balance, sale price and appraisal, mortgage payment, borrower income, type of mortgage, term, interest rate, and street address of the borrower. This file was updated with an October 2006 extract from

the SFDW with the dates of 90-day delinquencies, and of claim and non-claim terminations through September 30, 2006, and the loss figures for all REO cases resolved through September 2006.<sup>10</sup>

In addition to the national file, Concentrance drew random samples of about 1,000 loans from each of three MSAs, Atlanta, Indianapolis, and Salt Lake City, over the same time period. These MSAs were selected by HUD because of their high incidence of seller-funded downpayment assistance.

The samples were limited to loans with LTV ratios greater than 95%, as defined in FHA's SFDW. Since FHA's definition of LTV excludes the upfront mortgage insurance premium, which is generally rolled into the mortgage, in effect almost all of these loans had LTV ratios, as conventionally defined, greater than 96.5%, as FHA's upfront premium was 1.5% for most of the sample period. Loans with LTVs greater than 96.5% constitute almost 90% of FHA's purchase money loans, and constitute over 90% of FHA's claims. Because FHA allows some closing costs to be financed, and allows the financing of the upfront premium, FHA loans can, in some circumstances, slightly exceed 100% LTVs. In this sample, almost 85% of the records had LTVs in the narrow range of 98% to 100%, and about 99% were between 95% and 101%, as conventionally defined, that is, the original loan amount (including financed MIP) divided by the lesser of sales price or appraised value.

The median price in the national sample was \$110,000. About 99% of the loans were for a term of 30 years, with the remainder generally for 15 years. About 6% of the loans were for condominiums, and about 8% of the loans were one-year ARMs, with the balance being fixed-rate mortgages (FHA did not offer hybrid ARMs at that time). Just over 80% of the loans were to first time home buyers, and about 40% were in underserved area census tracts, as defined by HUD.<sup>11</sup> See Exhibit 1 for variable definitions and Exhibit 2 for sample summary statistics for key variables.

### **Source of Downpayment**

Concentrance reviewed paper files for all mortgages in the sample to determine the source of the downpayment. The coding scheme included four fields for source of gift, and four fields for the dollar amount of the gift, so that transactions with multiple gifts could be tracked. No transaction had four gifts, and only three out of the over 8,000 transactions had three gifts. The gift source codes identified gifts from relatives (the single largest category), gifts from government agencies, employers or unions, or nonprofits (the second largest category). The coding scheme did not differentiate between seller-funded nonprofits and more traditional nonprofits. The coders did capture the name and Taxpayer ID Number (TIN), when available, of the nonprofit in the gift letter. GAO, for its 2005 report on seller-funded nonprofit assistance, used the name and TIN to classify each nonprofit loan as seller-funded, not seller-funded, or unknown. The latter category included both cases in which the named nonprofit could not be found, and nonprofits, such as Indiana's Habitat for Humanity, that ran both types of programs. This was accomplished via an analysis of the nonprofit's website, IRS filing, or a phone call to the nonprofit. About 94% of the nonprofit-assisted loans in the sample were seller-funded, with the rest evenly split between the not seller-funded category and the unknown category.

**Exhibit 1. Variable Definitions**

Variable	Description
<b>Dependent</b>	
<i>Cumulative delinquent rate</i>	At least one reported delinquency of 90+ days by Sept. 30 2006
<i>Cumulative claim rate</i>	Whether FHA paid a claim for credit losses (usually REO)
<i>Cumulative prepay rate</i>	Non-claim termination by Sept. 30, 2006
<i>Loss severity rate</i>	For claim terminations, amount paid by FHA, divided by UPB
<b>Time Invariant Independent</b>	
<i>Frontend ratio</i>	Ratio of housing payment to borrower income
<i>LTV ratio</i>	Loan amount divided by lesser of sales price or appraisal
<i>FICO (/100)</i>	Borrowers FICO score (average if multiple scores in data)
<i>NoFICO</i>	Indicator for loan files without FICO scores
<i>Reserves &lt; 2 months</i>	Indicator for borrowers with reserves under 2 months housing payments
<i>Underserved area</i>	Low Income/minority census tract as defined by HUD
<i>Condominium</i>	Condominium
<i>First time</i>	First Time Homebuyer
<i>Builder</i>	Indicates that the property seller is a builder
<i>ARM</i>	1 year Adjustable Rate Mortgage
<i>DAPGift</i>	Indicates gift from a seller-funded Downpayment Assistance Provider
<i>OtherGift</i>	Indicates gift from a non-DAP source, such as a relative or government
<i>AnyGift</i>	Indicates a gift from either of the above sources
<b>Time-Varying Independent</b>	
<i>GAORisk</i>	Predicted value from the claim regression in GAO's 2001 report
<i>Appreciation</i>	Ratio of OFHEO current price index to index at origination, 2 quarter lag
<i>Releqhi</i>	The ratio of the market to book value of the mortgage, when > 1, else 1
<i>Releqlo</i>	The ratio of the market to book value of the mortgage, when < 1, else 1
<i>Y1-Y4</i>	4 annual time splines, in quarters
<i>Y5</i>	Quarterly time spline continued for years 5 to 7

Three indicator variables were created for the source of the downpayment. One variable, *AnyGift*, was set to 1 when a gift was the source for at least some of the borrower's contribution. The other, *DAPGift* (Downpayment Assistance Program), was set to 1 when more than half of the gift money came from a nonprofit known to be seller-funded, such as Nehemiah or AmeriDream. This was based on GAO's determination of seller-funded status. *OtherGift* was set to 1 if there was a gift that was not primarily DAP funded, so that *AnyGift* represents the union of *DAPGift* and *OtherGift*.

Attempts were made to use the size of the gift as an independent variable, but in over 80% of the cases with gifts but without DAP involvement, the gift was in the range of 2.75% to 3.75% of the sale price, while in the case of DAP-assisted loans, more than 90% of the transactions had total gift money of 2.75% to 3.75%. Thus, the assistance was very close to the 3% borrower contribution required by FHA. There was insufficient variability to test for effects based on the size of the gift. There were very few cases that involved assistance from both seller-funded nonprofits and other sources. In most of these cases, the nonprofit provided the bulk of the gift funds.

### Delinquency and Termination Data

In the national sample, about 17% of the loans experienced at least one episode of serious delinquency by September 30, 2006 (the cumulative delinquency rate). About 7.9% of

Exhibit 2. Summary Statistics

Variables	National Sample		Atlanta Sample		Indianapolis Sample		Salt Lake City Sample	
	Mean	Sigma	Mean	Sigma	Mean	Sigma	Mean	Sigma
Dependent								
<i>Cumulative delinquent rate</i>	17.0%		21.4%		23.2%		14.0%	
<i>Cumulative claim rate</i>	6.9%		9.7%		13%		9.6%	
<i>Cumulative prepay rate</i>	75.1%		69.5%		67.3%		83.4%	
<i>Loss severity (× 100)</i>	37.7	24.4	27.4	14.4	51.9	17.4	41.5	16.1
Time Invariant Independent								
<i>Frontend ratio</i>	0.258	0.076	0.266	0.068	0.244	0.067	0.290	0.067
<i>LTV ratio</i>	0.990	0.012	0.988	0.012	0.990	0.007	0.986	0.016
<i>FICO (/100)</i>	6.553	0.611	6.424	0.587	6.472	0.670	6.672	0.574
<i>NoFICO</i>	7.6%		7.6%		5.8%		12.0%	
<i>Reserves &lt; 2 months</i>	28.0%		24.0%		23.3%		24.0%	
<i>Underserved area</i>	40.8%		41.5%		26.6%		39.6%	
<i>Condominium</i>	8.4%		4.2%		3.3%		12.0%	
<i>First time</i>	80.9%		81.7%		82.2%		84.5%	
<i>Builder</i>	14.2%		31.7%		45.7%		19.8%	
<i>ARM</i>	7.0%		9.8%		11.3%		13.2%	
<i>DAPGift</i>	9.9%		31.9%		40.2%		28.1%	
<i>OtherGift</i>	35.0%		50.9%		54.7%		62.2%	
Time Varying Independent								
<i>GAORisk</i>	7.04	2.14	6.80	1.90	6.35	2.07	6.33	2.15
<i>Appreciation</i>	1.10	0.13	1.07	0.07	1.05	0.05	1.03	0.04
<i>Releqhi</i>	1.16	0.13	1.15	0.13	1.14	0.13	1.10	0.12
<i>Releqlo</i>	0.98	0.65	0.98	0.05	0.98	0.07	0.97	0.06

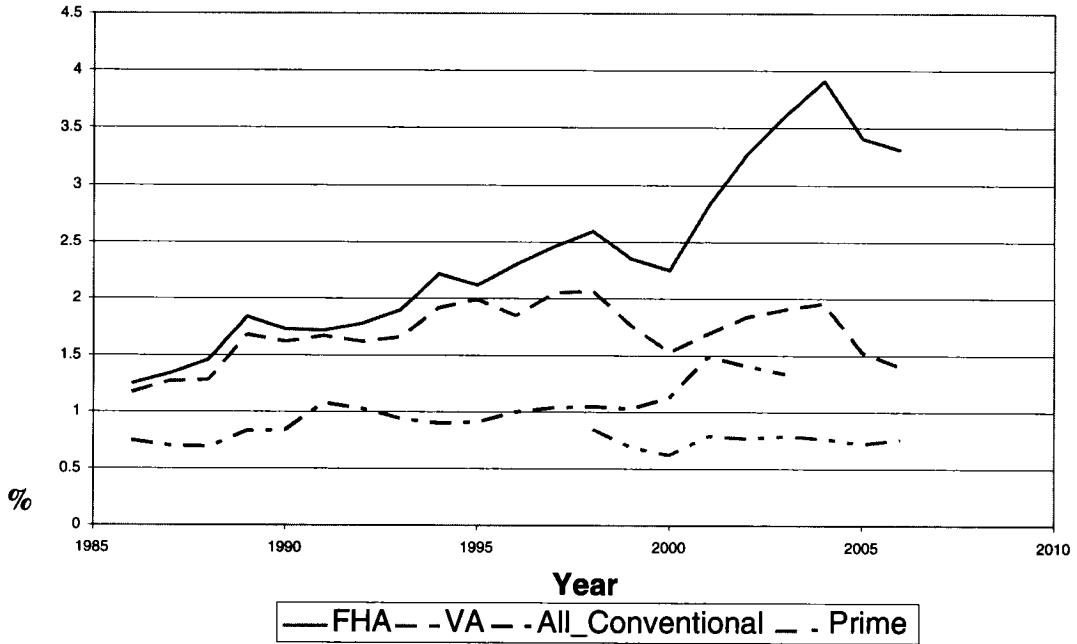
Notes:  $N = 5,097$  for the national sample;  $N = 1,177$  for the Atlanta sample;  $N = 1,126$  for the Indianapolis sample; and  $N = 1,110$  for the Salt Lake City sample.

the loans in the sample resulted in a claim on the FHA insurance by September 30, 2006, generally through foreclosure. For the 233 loans with a claim that had completed the property disposition process, the average net loss was 38% of the original mortgage balance. Just over 80% of the loans in the sample had terminated by the September 30, 2006 end of the observation window, either through prepayment or claim termination. Interest rates reached a local minimum in 2003, and prepayment rates were fairly high for these cohorts. Twenty-one percent of the loans that were still active on September 30, 2006 had experienced at least one episode of serious delinquency.

The MSA sample had higher rates of delinquency, foreclosure, and termination. About 20% of these loans experienced serious delinquency, and almost 12% ended in a claim. Loss rates were higher than those for the national sample in Salt Lake City and Indianapolis, but a little lower in Atlanta. About 85% of the loans in the MSA sample had terminated by the end of the observation window; 22% of the surviving loans had experienced serious delinquency.

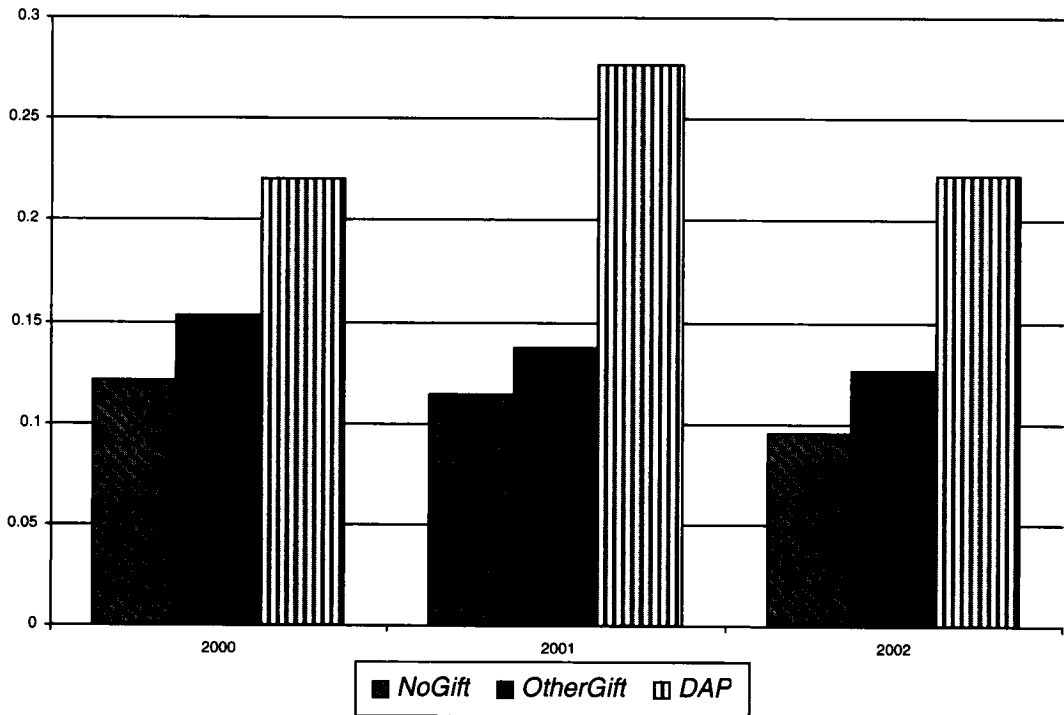
Exhibits 3–6 show raw delinquency and claim percentages for the National and MSA samples. Loans with involvement from Downpayment Assistance Programs (DAPs), which effectively have no downpayment, consistently showed the highest delinquency and claims. Loans with a downpayment from a source other than the borrower, such as a

Exhibit 3. Foreclosures Started 1986-2006

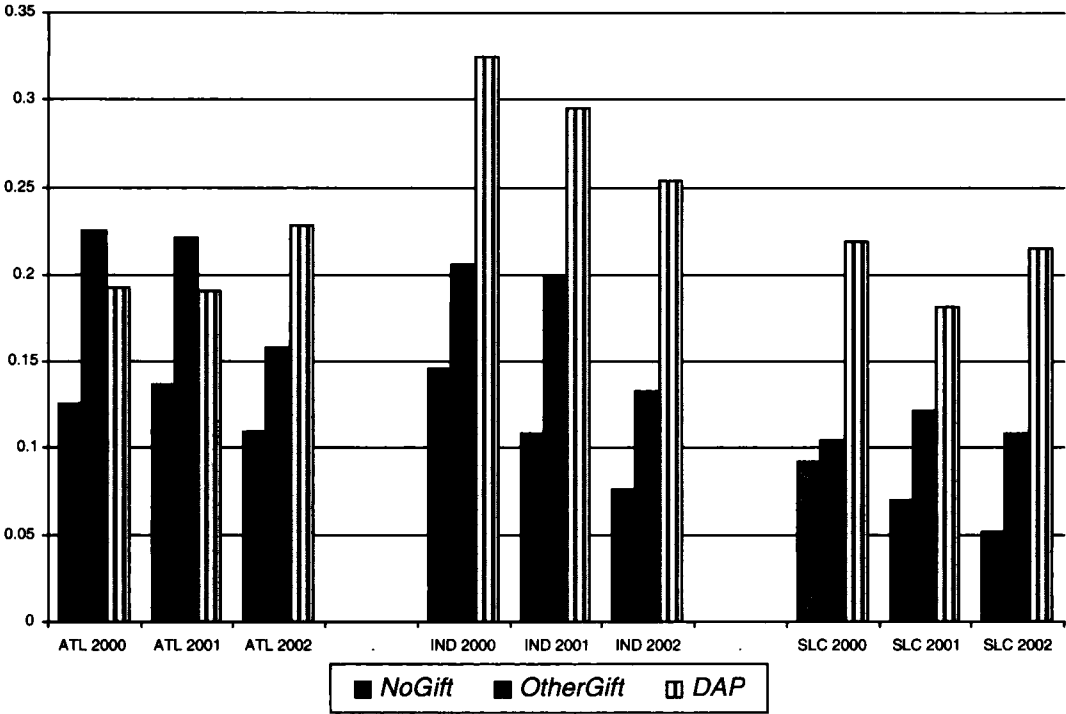


Notes: Conventional category dropped in 2004; Prime category added in 1997. The source is the Mortgage Bankers Association.

Exhibit 4. Delinquency: National Sample



**Exhibit 5. Delinquency: MSA Sample**



**Exhibit 6. Claim Rates: National Sample**

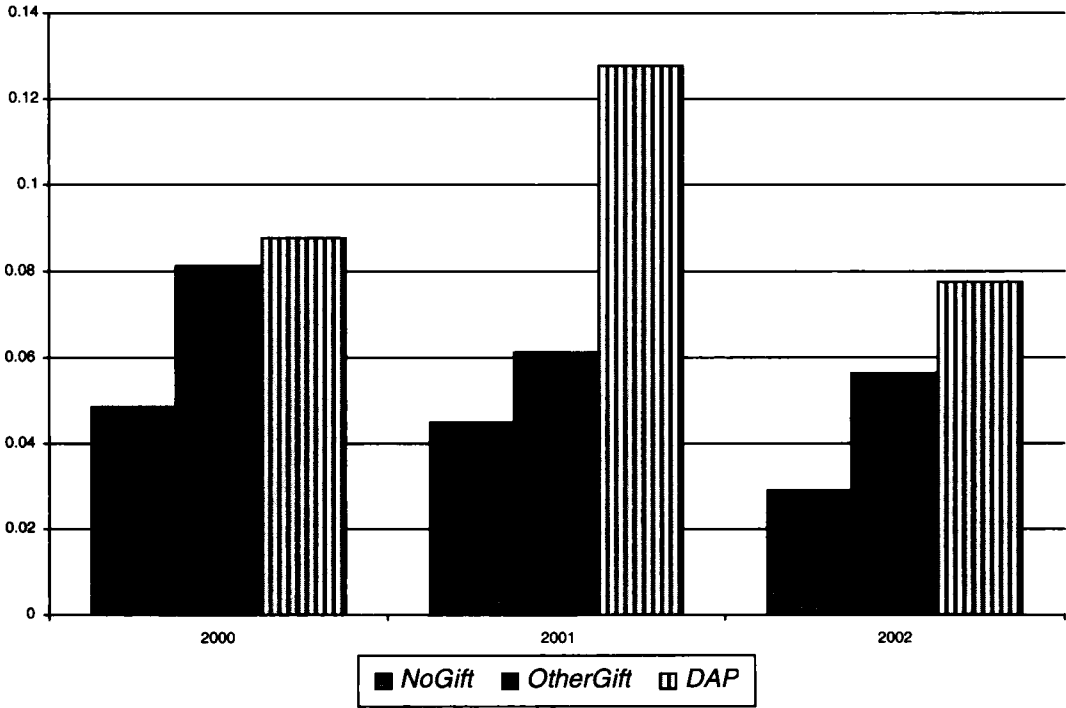
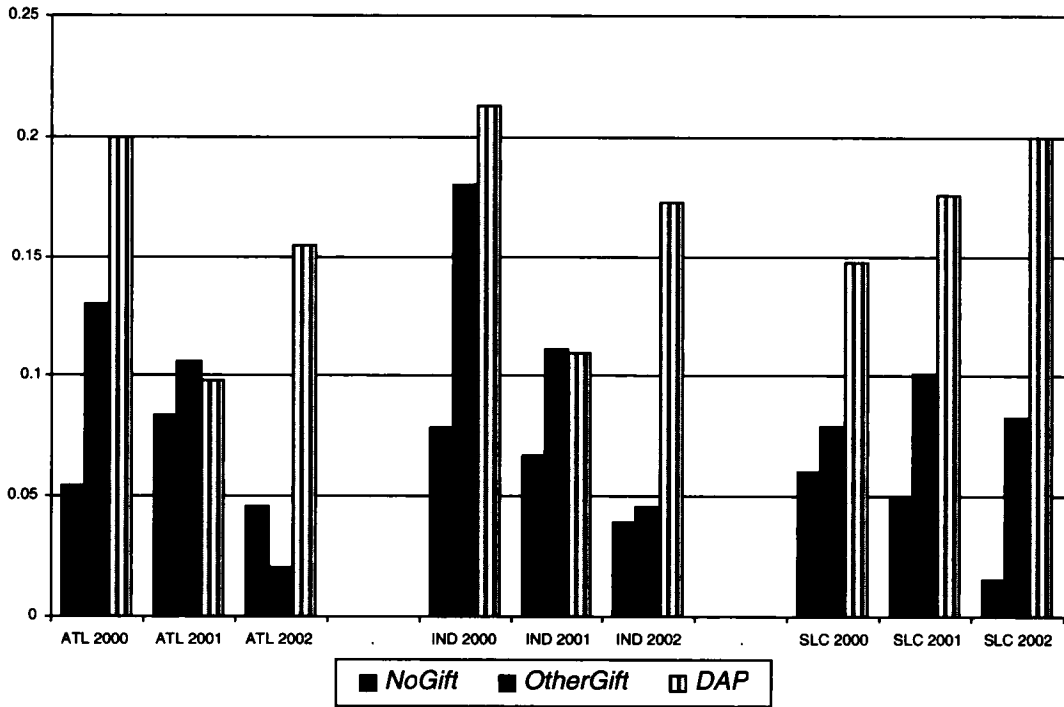


Exhibit 7. Claim Rates: MSA Sample



relative or government program, had lower claim and delinquency propensities, while loans with downpayments from the borrower's resources consistently showed the lowest rates of claim and delinquency.

### External Data

These files were merged with several external sources to incorporate time-varying covariates for the hazard analysis. State-level unemployment rates were obtained from BLS, the state-level constant quality house price index was obtained from OFHEO, 30-year fixed-rate mortgage rates were taken from Freddie Mac's Primary Mortgage Market Survey, and one-year Treasury rates were taken from the Fed. Price appreciation and unemployment,<sup>12</sup> were used to model the incentives to default or prepay, the 30-year fixed mortgage rate was used to calculate the market value of equity for fixed-rate loan default incentives and the ratio of market-to-book equity for fixed-rate loan prepayment incentives, and the one-year Treasury rate was used to annually update the payment information for one year ARMs.

### Trends

In both the national and the MSA samples, gift assistance grew over time. Use of seller-funded nonprofit assistance grew rapidly, while gifts from other sources (primarily relatives) slowly declined. In the national sample, gifts from relatives fell from 24% of loans in FY 2000 to 17% in FY 2002, while gifts from seller-funded nonprofits rose from

6% to 16%. Other gifts, such as those from employers, government agencies, or other nonprofits, fell from 6% to 3%. In total, gift-assisted loans rose over the 2000 to 2002 period from 36% to 37% of FHA endorsements.<sup>13</sup>

In the MSA sample, seller-funded nonprofit assistance was a much higher percentage, other assistance was smaller, and overall assistance was somewhat higher than for the national sample. HUD chose these MSAs for their high rates of DAP usage. Seller-funded nonprofit assistance also grew over time for the MSA sample.

Despite the booming housing market over the 2000–2006 period, FHA claim rates have been rising. Data on foreclosure initiations from the Mortgage Banker's Association shows annual FHA foreclosure initiations rising from almost 2.5% in 2000 to almost 4% in 2004, before retreating slightly to about 3.5% in 2005–2006, while VA and conventional rates have stayed fairly flat (see Exhibit 3). This may, in part, be explained by the rising incidence of seller-funded assistance. Exhibits 3–6 show claim and delinquency rates for FHA loans by fiscal year of endorsement and type of assistance. Assisted loans have consistently higher rates of delinquency and claim, with seller-funded assistance loans showing worse performance than do loans with other types of assistance. The MSA sample has higher rates of poor performance, and generally larger differences between assistance categories. This is consistent with the fact that the three MSAs in the sample had lower rates of house price appreciation than did the nation as a whole. Atlanta's annual appreciation averaged 5%, just below the median for FHA loans, at 6%. Indianapolis and Salt Lake City had annual rates of appreciation of about 4%.

### Estimation Strategy

To estimate the effect of the source of the downpayment on claim and delinquency propensities, the instantaneous conditional claim (or delinquency) rate was modeled using James Heckman's Continuous Time Models (CTM) program (Yi, Walker, and Honoré, 1985). Prepaid loans were a competing risk treated as censored on the date of prepayment. The hazard rate framework was chosen to allow for the inclusion of time-varying covariates, such as post origination price appreciation. The continuous time framework eliminates the need for the arbitrary treatment of ties that is necessary with competing risks in a discrete time framework, such as bivariate logits estimated with annual or quarterly termination data. In the discrete time framework, assuming that a loan which prepays in a given quarter was at risk of default in the same quarter, can give qualitatively different answers than assuming that a loan that prepays was not at risk of default in the quarter of prepayment.

CTM is a FORTRAN-based package with a long history in labor econometrics. It estimates competing risk termination models with a flexible (Box-Cox) parametric baseline hazard, and allows for the choice of any of several parametric forms of unobserved heterogeneity, or Heckman-Singer non-parametric heterogeneity (Heckman and Singer, 1985). Unobserved heterogeneity is usually referred to in mortgage modeling as "burnout"—the tendency for some loans to terminate faster than observationally similar loans, so that conditional termination rates fall over time, despite unchanging conditions.

CTM was first applied to mortgage analysis in GAO's third report on the actuarial soundness of the FHA single family program (GAO, 1996), and has also been used to

model FHA multifamily mortgage terminations (Ondrich and Huang, 2001). Regressions incorporating unobserved heterogeneity have also been estimated with other routines. For example, Stanton (1996) estimates a single termination risk model of prepayment with a gamma heterogeneity distribution, and Deng, Quigley, and VanOrder (2000) estimate a competing risk model with Heckman and Singer (1985) non-parametric heterogeneity using McCall's software program. The McCall model estimated by Deng, Quigley, and VanOrder is essentially the same as the Heckman model, except for the use of a non-parametric, rather than a flexible parametric, baseline hazard function.<sup>14</sup>

CTM estimates an equation of the form:

$$b_f(t_j|x(u))_0^\infty, \theta) = \exp[\Sigma(\tau_{jk}\beta_{jk}) + \gamma_f(t^\lambda - 1)/\lambda + c_{ij}\theta], \quad (1)$$

where  $b$  is the instantaneous hazard from the original state (active loan) to the destination state at duration  $t$ ,  $j$  indexes the destination state, default or prepayment,  $t$  is time (days divided by 100), and  $x(u)$  and the theta vectors representing conditioning information. The hazard function is separable into three components. First, tau and beta are vectors of independent variables and their coefficients. The next component is the baseline hazard and duration dependence, with lambda as the Box-Cox parameter on time and gamma measuring duration dependence. Finally, the thetas are points of support for the heterogeneity distribution and the cs are the associated factor loadings for each transition, serving to scale the points of support, which are bounded in the interval 0,1. The points of support are the initial distribution of intercepts across borrowers.

Two strategies were employed in choosing other covariates for the termination regression. In one, time-invariant variables of the type used in FHA's TOTAL Scorecard automated underwriting system were chosen. These are *FICO* score,<sup>15</sup> *LTV* at origination, an indicator for whether the borrower will have less than two months of reserves after closing, and the ratio of the monthly housing expense to the borrowers' monthly income (*Front End ratio*). These variables were augmented by other loan, borrower, and property variables that might influence credit risk, such as indicators for first-time home buyers and properties in underserved areas. A time-varying covariate is also included to measure post-origination price appreciation, defined as the state-level percentage change in the OFHEO price index, measured quarterly, with a two quarter lag. For the first two quarters of the loan's life, this value is set to 0; starting with the third quarter, the value is calculated by subtracting one from the ratio of the price index two quarters prior to the current quarter and the price index at origination (the claim process is lengthy for FHA loans).

The second strategy was designed to control for more covariates, despite the relatively small sample size (about 5,000 in the national sample and about 3,000 in the MSA sample). In 2001, GAO estimated competing risk hazard models using millions of FHA loans originated between 1975 and 1999.<sup>16</sup> Explanatory variables for credit risk included *LTV* at origination, an estimate of contemporaneous *LTV* using changes in the OFHEO index as described above, geographic controls for Census division and judicial foreclosure states, unemployment rates (defined as the log of the four quarter moving average in state unemployment rates, lagged one quarter),<sup>17</sup> and, for ARM loans, an estimate of the change in payments over time, based on annual changes in the one year Treasury rate. Separate

models were run for 30-year fixed, investor, 15-year fixed, and ARM loans. The coefficients from these regressions were combined with the Concentrance data to form a mortgage score, and this score (*GAORisk*) was used as an independent variable along with important variables not in the GAO model, such as *FICO* score and reserves.

For prepayment, the key driver was a calculation of the refinancing incentive, defined as the ratio of the market value of the mortgage to the book value of the mortgage. Market value of the mortgage was defined as the present value of the remaining mortgage payments, discounted by the Freddie Mac 30-year mortgage rate (or 15-year, for these FRMs). The effective rate was used to include the effect of refinancing costs on the refinancing incentive. The variable was splined at one, to reflect the differing incentives for borrowers with premium or discount mortgages. The variable was set to one for ARMs, essentially assuming that the book and market values remained close for these loans.

The final regressions were of the form:

$$(Default_t / Survivor_t)$$

$$= \text{Exp}(f(\text{Risk Covariates}_t, \text{Source of Downpayment}, \text{Unobserved Heterogeneity})).$$

(2)

and

$$(Prepayment_t / Survivor_t)$$

$$= \text{Exp}(f(\text{Risk Covariates}_t, \text{Source of Downpayment}, \text{Unobserved Heterogeneity})).$$

(3)

### Estimation Results

Exhibits 8 and 9 present results for the national sample, with 90 day delinquency<sup>18</sup> or claim as a termination state, and prepayment as the competing risk. The first specification uses the *GAORisk* variable, which incorporates initial LTV, loan type, post-origination appreciation, unemployment rate, etc. into one combined variable, while the second uses the TOTAL scorecard specification, in both cases augmented with other variables that might influence credit risk. Exhibits 9 and 10 show the same analysis for the MSA sample. Although CTM jointly estimates default, prepayment, and heterogeneity, in the interest of space the prepayment results are presented only for the national sample claim regressions. Exhibit 11 shows the results of OLS regressions predicting loss given default.

### National Sample Results

Signs were as expected for both gift indicator variables. When the dependent variable was 90 day delinquency, the *ANYGift* variable indicated that serious delinquencies were about 29% higher<sup>19</sup> for loans with gift downpayments that were not funded by sellers, relative to comparable loans with downpayments from the buyers' own funds. The *DAPGift* coefficient indicates that seller-funded nonprofit gift assistance, essentially loans with no downpayment, had delinquency rates about 50% higher than the rate for

Exhibit 8. Delinquency Hazard National Sample

	GAORisk Specification			TOTAL Scorecard Specification		
	Coeff.	Std. Error	p-value	Coeff.	Std. Error	p-value
<i>Intercept</i>	3.719	0.530	0.001	9.779	3.125	0.002
<i>DAPGift</i>	0.417	0.113	0.001	0.407	0.113	0.001
<i>AnyGift</i>	0.252	0.086	0.003	0.257	0.085	0.002
<i>GAORisk</i>	0.071	0.022	0.001			
<i>Appreciation</i>				0.147	0.224	0.512
<i>LTV</i>				-0.056	0.031	0.071
<i>ARM</i>				-0.423	0.150	0.005
<i>FICO</i>	-0.957	0.066	0.001	-0.986	0.064	0.001
<i>NoFICO</i>	0.470	0.116	0.001	0.451	0.116	0.001
<i>Reserves</i>	0.103	0.084	0.220	0.130	0.084	0.122
<i>FrontEnd</i>	1.139	0.500	0.023	1.184	0.502	0.018
<i>Underserved</i>	-0.004	0.073	0.956	-0.014	0.073	0.848
<i>Condominium</i>	-0.134	0.151	0.375	-0.238	0.163	0.144
<i>FirstTime</i>	-0.096	0.104	0.356	-0.119	0.105	0.257
<i>Builder</i>	-0.054	0.109	0.620	-0.087	0.108	0.420
<i>Gamma</i>	1.258	0.090	0.001	1.356	0.106	0.001
<i>Lambda</i>	0.744	0.134	0.001	0.599	0.109	0.001
<i>Factor_Load</i>	-0.175	0.275	0.525	0.215	0.267	0.421
<b>Unobserved Heterogeneity</b>	<b>Cumulative Probability</b>	<b>Location</b>		<b>Cumulative Probability</b>	<b>Location</b>	
	0.155	0		0.139	0	
	0.483	0.604		0.432	0.612	
	1.000	1.000		1.000	1.000	

Notes: The log likelihood for *GAORisk* Specification is -5,410; the log likelihood for *TOTAL Scorecard* Specification is -5,362.

comparable loans with assistance from a disinterested third party. When *Claim* is the dependent variable, the results are similar, with gift assistance raising claims by 40% to 48%, and *DAPGift* assistance raising claims by an additional 38% to 50%. All estimated effects are significant at 1% for delinquency, and at 5% in one-tailed tests for claims.

Results were mixed for other covariates. The *FICO* score has a very strong effect with the expected sign, as does the *Frontend* ratio. The measure of post-origination price appreciation has a strong effect in the *Claim* regression, but not the *Delinquency* regression (in fact, the sign is "wrong" although the *p*-value is weak). This is less surprising in light of the fact that delinquency is normally thought of as a cash flow issue for the borrower while foreclosure is primarily determined by contemporaneous equity. The *GAORisk* variable is also positive and highly significant in the claim and delinquency regressions. *LTV* is not significant, presumably because there is so little variation in *LTV* in this sample of very high *LTV* loans. Reserves of less than two months are also not significant, although they are close to significant in one delinquency specification.

## Exhibit 9. Termination Hazard National Sample

	GAORisk Specification			TOTAL Scorecard Specification		
	Coeff.	Std. Error	p-value	Coeff.	Std. Error	p-value
<i>CLAIM</i>						
<i>Intercept</i>	0.658	0.864	0.446	13.551	6.402	0.034
<i>DAPGift</i>	0.407	0.184	0.027	0.321	0.182	0.078
<i>AnyGift</i>	0.392	0.143	0.006	0.340	0.142	0.017
<i>GAORisk</i>	0.159	0.036	0.001			
<i>Appreciation</i>				-4.141	0.744	0.001
<i>LTV</i>				-0.057	0.064	0.373
<i>ARM</i>				-0.650	0.289	0.025
<i>FICO</i>	-0.843	0.119	0.001	-0.875	0.115	0.001
<i>NoFICO</i>	0.886	0.182	0.001	0.871	0.180	0.001
<i>Reserves</i>	-0.085	0.147	0.563	-0.077	0.145	0.595
<i>FrontEnd</i>	1.514	0.851	0.075	2.312	0.859	0.007
<i>Underserved</i>	-0.020	0.123	0.871	0.041	0.122	0.737
<i>Condominium</i>	-0.275	0.290	0.343	-0.254	0.312	0.416
<i>FirstTime</i>	-0.306	0.158	0.053	-0.288	0.156	0.065
<i>Builder</i>	0.171	0.170	0.314	0.023	0.170	0.892
<i>Gamma</i>	0.433	0.178	0.015	1.343	0.226	0.001
<i>Lambda</i>	-1.450	0.386	0.001	-0.616	0.221	0.005
<i>Factor_Load</i>	1.057	0.686	0.123	-0.662	0.596	0.267
<i>PREPAY</i>						
<i>Intercept</i>	-12.436	0.861	0.001	-12.432	2.958	0.001
<i>DAPGift</i>	-0.176	0.090	0.051	-0.163	0.095	0.086
<i>AnyGift</i>	-0.083	0.059	0.159	-0.044	0.062	0.478
<i>GAORisk</i>	-0.088	0.019	0.001			
<i>Appreciation</i>				2.840	0.247	0.001
<i>LTV</i>				-0.089	0.028	0.001
<i>ARM</i>				1.120	0.116	0.001
<i>FICO</i>	0.405	0.042	0.001	0.407	0.043	0.001
<i>NoFICO</i>	-0.363	0.090	0.001	-0.312	0.096	0.001
<i>Reserves</i>	0.056	0.056	0.317	0.051	0.059	0.387
<i>FrontEnd</i>	1.933	0.334	0.001	1.589	0.345	0.001
<i>Underserved</i>	-0.251	0.050	0.001	-0.296	0.052	0.001
<i>Condominium</i>	0.220	0.092	0.017	-0.015	0.105	0.886
<i>FirstTime</i>	-0.262	0.064	0.001	-0.271	0.066	0.001
<i>Builder</i>	0.085	0.072	0.238	0.109	0.075	0.146
<i>Releqphi</i>	4.618	0.225	0.001	5.084	0.225	0.001
<i>Releqplo</i>	5.889	0.780	0.001	5.819	0.795	0.001
<i>Gamma</i>	0.246	0.065	0.001	0.028	0.016	0.080
<i>Lambda</i>	-0.656	0.146	0.001	-1.508	0.266	0.001
<i>factor_loading</i>	-3.456	0.499	0.001	4.486	0.293	0.001
<b>Unobserved Heterogeneity</b>	<b>Cumulative Probability</b>			<b>Cumulative Probability</b>		
		<b>Location</b>			<b>Location</b>	
	0.540	0		0.135	0	
	0.873	0.459		0.432	0.577	
	1.000	1.000		1.000	1.000	

Notes: The log likelihood for GAORisk Specification is -4,856; the log likelihood for TOTAL Scorecard Specification is -4,759.

Exhibit 10. Delinquency Hazard MSA Sample

	GAORisk Specification			TOTAL Scorecard Specification		
	Coeff.	Std. Error	p-value	Coeff.	Std. Error	p-value
<i>Intercept</i>	1.662	0.593	0.005	1.560	6.482	0.810
<i>DAPGift</i>	0.375	0.111	0.001	0.390	0.109	0.001
<i>AnyGift</i>	0.324	0.128	0.011	0.296	0.125	0.018
<i>GAORisk</i>	0.129	0.030	0.001			
<i>Appreciation</i>				3.979	1.037	0.001
<i>LTV</i>				-0.028	0.065	0.667
<i>ARM</i>				-0.300	0.120	0.012
<i>FICO</i>	-0.818	0.077	0.001	-0.803	0.076	0.001
<i>NoFICO</i>	0.345	0.129	0.007	0.365	0.127	0.004
<i>Reserves</i>	0.061	0.108	0.572	0.043	0.106	0.685
<i>FrontEnd</i>	2.501	0.646	0.001	2.019	0.629	0.001
<i>Underserved</i>	0.067	0.087	0.441	0.054	0.084	0.520
<i>Condominium</i>	0.155	0.190	0.415	0.140	0.210	0.505
<i>FirstTime</i>	-0.053	0.119	0.656	-0.028	0.116	0.809
<i>Builder</i>	-0.070	0.096	0.466	-0.001	0.092	0.991
<i>Gamma</i>	1.355	0.138	0.001	0.451	0.193	0.019
<i>Lambda</i>	0.674	0.146	0.001	-0.151	0.272	0.579
<i>Factor_Load</i>	0.902	0.279	0.001	-0.112	0.264	0.671
<b>Unobserved Heterogeneity</b>	<b>Cumulative</b>			<b>Cumulative</b>		
	<b>Probability</b>	<b>Location</b>		<b>Probability</b>	<b>Location</b>	
	0.199	0		0.211	0	
	0.400	0.618		0.347	0.59	
	1.000	1.000		1.000	1.000	

Notes: The log likelihood for *GAORisk* Specification is -3,102; the log likelihood for *TOTAL Scorecard* Specification is -3,101.

However, few FHA borrowers have large reserves after closing, and this variable may have significant measurement error, as industry participants have noted that originators often document only enough assets to qualify the borrower. If this is the case, the reserves of the safest borrowers may be the most understated. The indicators for condominium loans, loans where the seller was a builder (generally new construction), and loans in underserved areas were not significant, but there was no theoretical expectation for a particular sign for these variables. *First Time Homebuyer* was close to significant, with a negative sign.

The heterogeneity results are similar to those found in GAO (1996) or Deng, Quigley, and VanOrder (2000). For the national sample, the model estimates that there are three categories of borrowers, with a little less than 50% in the rapid prepayment category, and the rest divided between the medium and slow prepayment category. Because the factor loadings are opposite in sign for the claim and prepayment regressions, borrowers who are fast prepayers are predicted to be slow claim terminators, a result consistent

Exhibit 11. National Terminations: Logistic Regression

CLAIM	GAORisk Specification		TOTAL Scorecard Specification	
	Coeff.	t-Stat.	Coeff.	t-Stat.
<i>Intercept</i>	-9.175	3.56	1.906	0.35
<i>DAPGift</i>	0.411	2.35	0.330	1.88
<i>AnyGift</i>	0.387	2.78	0.348	2.50
<i>GAORisk</i>	0.155	5.14		
<i>Appreciation</i>			-4.235	5.90
<i>LTV</i>			-0.062	1.30
<i>ARM</i>			-0.654	2.26
<i>FICO</i>	-0.845	7.90	-0.888	8.38
<i>NoFICO</i>	0.851	5.01	0.872	5.11
<i>Reserves</i>	-0.076	0.53	-0.067	0.47
<i>FrontEnd</i>	1.755	2.17	2.492	3.01
<i>Underserved</i>	-0.051	0.43	0.028	0.24
<i>Condominium</i>	-0.287	1.00	-0.272	0.91
<i>FirstTime</i>	-0.354	2.34	-0.325	2.14
<i>Builder</i>	0.148	0.91	0.004	0.03
<i>y1</i>	1.628	2.58	1.792	2.85
<i>y2</i>	0.320	3.93	0.431	5.27
<i>y3</i>	0.114	2.04	0.196	3.44
<i>y4</i>	-0.023	0.42	0.048	0.87
<i>y5</i>	0.039	1.12	0.113	3.04
PREPAYMENT				
<i>Intercept</i>	-13.392	21.76	-11.938	7.98
<i>DAPGift</i>	-0.157	2.35	-0.146	2.18
<i>AnyGift</i>	-0.057	1.40	-0.046	1.13
<i>GAORisk</i>	-0.086	6.03		
<i>Appreciation</i>			1.966	12.78
<i>LTV</i>			-0.051	3.79
<i>ARM</i>			0.695	9.07
<i>FICO</i>	0.330	11.70	0.352	12.39
<i>NoFICO</i>	-0.261	3.93	-0.258	3.87
<i>Reserves</i>	0.063	1.62	0.063	1.62
<i>FrontEnd</i>	1.389	6.28	0.990	4.45
<i>Underserved</i>	-0.173	4.94	-0.212	6.03
<i>Condominium</i>	0.208	3.53	0.059	0.92
<i>FirstTime</i>	-0.134	3.09	-0.131	3.01
<i>Builder</i>	0.085	1.73	0.124	2.50
<i>releqphi</i>	3.022	18.88	2.999	19.25
<i>releqplo</i>	3.582	5.97	4.863	7.52
<i>y1</i>	0.572	16.40	0.475	14.04
<i>y2</i>	0.037	2.30	-0.022	1.33
<i>y3</i>	-0.086	4.80	-0.134	7.34
<i>y4</i>	-0.103	4.64	-0.150	6.65
<i>y5</i>	0.005	0.33	-0.074	4.11

with adverse selection at time of prepayment. The Box-Cox baseline hazard parameter, lambda, is negative and generally about -1 for the claim and prepayment regressions (but not for the delinquency regressions), implying that a baseline of the form 1/time gives a good fit to the data, a remarkably sensible form for the baseline, as it allows a

rapidly rising hazard in the early part of a loan's life followed by an essentially flat hazard. Except for GAO (1996), which finds a similar form, to the best of my knowledge no one has used such an inverse transform for a baseline mortgage termination hazard.

## MSA Sample Results

Exhibits 10 and 12 provide results for the MSA sample. Again, there are two specifications, one using the *GAORisk* variable, and the other using the TOTAL scorecard variables. The results for source of downpayment are even stronger in this set of cities with low price appreciation. For delinquency, traditional gift assistance raises the rate by 34% to 38%, and DAP raises the rate by an additional 45% to 48%. For claims, traditional gift assistance raises the rate by 55% to 59%, and DAP raises the rate by a further 44% to 54%. Gift assistance, and the differences between DAP and other gifts, are significant at 1% in one-tailed tests, except for one *Claim* specification, where the effect of a gift is significant at 5%, but not quite at 1%.

Exhibit 12. Claim Hazard MSA Sample

	GAORisk Specification			TOTAL Scorecard Specification		
	Coeff.	Std. Error	p-value	Coeff.	Std. Error	p-value
<i>Intercept</i>	-1.031	0.741	0.164	7.230	10.262	0.481
<i>DAPGift</i>	0.461	0.138	0.001	0.436	0.140	0.002
<i>AnyGift</i>	0.430	0.167	0.010	0.362	0.169	0.032
<i>GAORisk</i>	0.192	0.039	0.001			
<i>Appreciation</i>				-6.894	1.510	0.001
<i>LTV</i>				0.009	0.104	0.931
<i>ARM</i>				-0.381	0.176	0.030
<i>FICO</i>	-0.416	0.102	0.001	-0.443	0.101	0.001
<i>NoFICO</i>	0.581	0.152	0.001	0.526	0.153	0.001
<i>Reserves</i>	0.072	0.141	0.610	0.037	0.139	0.790
<i>FrontEnd</i>	1.871	0.836	0.025	1.951	0.827	0.018
<i>Underserved</i>	0.111	0.110	0.313	0.162	0.108	0.134
<i>Condominium</i>	0.149	0.237	0.530	0.116	0.290	0.689
<i>FirstTime</i>	0.003	0.158	0.985	0.032	0.155	0.836
<i>Builder</i>	0.023	0.123	0.852	-0.026	0.123	0.833
<i>Gamma</i>	0.857	0.235	0.001	1.624	0.299	0.001
<i>Lambda</i>	-1.251	0.375	0.001	-0.643	0.267	0.016
<i>Factor_Load</i>	-0.731	0.457	0.110	-0.195	0.450	0.665
Unobserved Heterogeneity	Cumulative			Cumulative		
	Probability	Location		Probability	Location	
	0.613	0		0.228	0	
	0.860	0.477		0.403	0.532	
	1.000	1.000		1.000	1.000	

Notes: The log likelihood for *GAORisk* Specification is -2,960; the log likelihood for TOTAL Scorecard Specification is -2,956.

Exhibit 13. Loss Rates: OLS Regression

	National Sample		MSA Sample		Atlanta Sample		Indianapolis Sample		Salt Lake City Sample	
	Parameter	T	Parameter	T	Parameter	T	Parameter	T	Parameter	T
Intercept	71.800	0.41	-175.728	-1.09	362.459	1.19	-160.274	-0.72	-178.695	-0.66
LTV	-0.078	-0.04	3.819	2.27	-3.364	-1.07	3.470	1.47	3.097	1.08
DAP	8.261	2.17	3.338	1.38	3.863	1.02	-2.430	-0.76	2.777	0.59
OtherGift	-0.455	-0.14	2.689	0.91	-1.059	-0.21	-1.679	-0.40	5.525	1.08
FICO	-0.005	-0.19	-0.012	-0.61	-0.014	-0.39	-0.016	-0.64	-0.014	-0.35
NoFICO	5.969	1.43	-1.478	-0.54	-0.586	-0.12	7.408	1.56	-2.981	-0.79
Appreciation	-16.853	-1.05	-78.820	-4.81	0.067	0.00	-51.336	-1.66	-85.500	-2.57
Interest	4.161	2.28	0.593	0.55	-0.762	-0.39	1.936	1.47	3.213	1.43
Mortgage \$	-0.552	-2.98	-1.110	-4.15	0.228	0.43	-1.373	-3.86	0.014	0.02
Mortgage \$ sq	0.001	1.51	0.004	2.99	-0.001	-0.50	0.005	2.99	-0.001	-0.39
R <sup>2</sup>	0.212		0.249		0.060		0.408		0.176	

Notes: For the National sample, N = 241; for the MSA sample, N = 298; for the Atlanta sample, N = 83; and for the Indianapolis sample, N = 122; and for the Salt Lake City sample, N = 93.

Results for the other covariates are generally similar to those in the national sample. Post-origination appreciation also has the wrong sign in the delinquency regression, and has a stronger, significant effect. In the MSA sample, appreciation was low and fairly constant over time, so that the co-linearity between appreciation and duration was fairly high in this sample. This may also be seen in the duration dependence parameter. Appreciation has the wrong sign in the TOTAL scorecard specification, but is forced to have the right sign in the *GAORisk* specification, as it is one of the variables used to create this mortgage score. The duration dependence parameter is substantially lower when appreciation is estimated with the wrong sign.

### **National Prepayment Results**

One disadvantage to working with conditional hazard rates is the potential for the competing risk of prepayment to influence the default regression results. It would be possible, for example, for gift indicators to have an impact on conditional claim rates, but not on unconditional claim rates, if gift assisted loans had higher prepayment rates. The conditional claim rates would be high, not because claims were high, but because survival was low. To test for this possibility, the conditional prepayment rate was jointly modeled as a function of standard prepayment variables, such as the refinancing incentive, defined as the ratio of the market value to the book value of the mortgage (splined at 1), standard underwriting variables, and gift downpayment indicator variables. CTM jointly models the competing risk of claim and prepayment termination (or delinquency vs. prepayment termination). In the interest of space, prepayment results are only presented for the national samples (Exhibit 11), but results were similar for the MSA sample regressions. The *GIFT* and *DAP* indicators both had small, negative, and significant impacts on prepayment rates, indicating the effect of a gift downpayment on cumulative claim rates is slightly higher than the impact on conditional claim rates.

### **Logistic Regression Results**

As a check on the influence of the chosen econometric technique on the results, the National *Claim* and *Prepayment* regressions were rerun using a pair of binary logits. The results are in Exhibit 11. Coefficients on the time-invariant variable, including the gift dummies, are similar, as are the significance levels on the coefficients. The major difference is in the time-varying variables in the prepayment regressions, where the refinancing incentive is estimated to have a weaker (but still highly significant) effect in the logistic regressions. Similar results, not included but available upon request, were found for the MSA sample.

### **Loss Given Default Results**

Turning to loss given default, OLS regressions indicate that loss rates, defined as the dollars lost on a defaulted loan divided by the unpaid principle balance, are influenced by the source of the downpayment (Exhibit 12). The gift variables are re-parameterized for the LGD regressions for expositional ease. The *DAP* variable represents seller-funded downpayments, while the *OtherGift* variable represents all other gift downpayments.

In both the national sample and the MSA samples, the presence of a seller-funded gift downpayment increases loss severity. In the national sample, seller-funded nonprofit gifts result in loss rates 8 percentage points higher than other loans, while other gifts, such

as gifts from relatives, have no effect. This is consistent with DAP gifts starting out with actual equity lower than that recorded in the underwriting. In the national sample, original mortgage amount and the original interest rate on the mortgage are also a significant determinant of losses, with larger losses on higher coupon loans, and smaller (percent) losses on larger loans, consistent with a substantial fixed cost component of total losses (foreclosure costs, for example). Post origination appreciation has a large effect, with smaller losses in faster appreciating states, but the estimated coefficient is not statistically significant. Gifts from other sources have no effect.

The effects for *DAP* are smaller in the MSA sample, and gifts in general raise loss severities, although neither effect is statistically significant (the *DAP* effect has a one-sided *p*-value of 0.08). Examining the effects of gifts in each MSA produces some conflicting results. In Atlanta, *DAP* gifts alone raise loss severities, while in Salt Lake City all gifts raise severity rates, with the biggest effect coming from non-seller-funded gifts. Neither type of gift has much effect in Indianapolis. But sample sizes are fairly small for each MSA, and no effect is precisely estimated.

## Conclusion

Both GAO (1993) and Deng, Quigley, and VanOrder (1996) estimated the cost of “no downpayment mortgages.” Both found the costs fairly modest, so long as house prices were increasing. However, neither analyzed a program in which no cash would be required from the borrower. In the 1993 GAO report, performance of no downpayment VA mortgages was analyzed, but VA limits the closing costs that can be financed by the seller, so buyers are generally required to bring cash to the table to make a purchase with the VA. Deng, Quigley, and VanOrder (1996) extrapolated Freddie Mac borrower behavior to a program with 100% LTVs, but did not explicitly address closing costs.<sup>20</sup> They projected 16% lifetime foreclosure rates for mid-range price appreciation in their worst case income and unemployment simulations. The three MSAs examined in this paper have comparable price appreciation to their mid-range case, and claim rates over 18% for the seller-funded nonprofit category, although they are only in their 5<sup>th</sup> through 7<sup>th</sup> years. Apparently, no cash from borrower, fully financed mortgages are even more risky than the Deng, Quigley, and VanOrder (1996) or 1993 GAO projections would indicate. The MSA sample results may better reflect “normal” housing market conditions than the national sample results, as the data span a period of unprecedented national house price appreciation, unlikely to be repeated. It is interesting to note that even heavily targeted affordable programs, such as GSE community lending programs, generally require some cash from borrowers. For example, the GSEs have 3-2 programs for community lending, in which 3% of a 5% downpayment could come from gifts, and 2% from the borrowers.

This paper examines the case of literally “no money from the buyer” mortgages, and finds delinquencies and claim rates much higher than those for comparable loans with cash from the borrower. The results for non-seller-funded gifts are not consistent with a “ruthless” equity driven default decision, as these loans should have equity for gifts that are truly gifts. In the national sample, relieving the buyer of the need to contribute cash to the purchase, via a gift from an uninvolved party, raises the claim rate by 40% to 50%.

Relieving the buyer of the need to contribute cash to the purchase, by a "gift" from the seller that results in a higher loan amount, raises the claim rate by an additional 38% to 50%. The extra difference in claim rates for gifts from seller-funded nonprofits is broadly consistent with an equity-based explanation, as a 25% increase in claims for a 3% decrease in equity (this assumes that seller funding yields a dollar for dollar increase in sales price) is implied by an extrapolation of FHA termination models that included a broad range of LTVs, such as GAO's 1996 FHA actuarial model. The difference between the effects of traditional and seller-funded gifts is only slightly higher than the difference that may be attributed to the difference in equity between these two categories of loan.

The results are consistent with most non-seller-funded gifts being true gifts, and with the implications of Krumm and Kelly (1989), or Haurin, Wachter, and Hendershott's (1995) work on transitions to homeownership. Some renters are flexible, able to adjust consumption and labor force participation, and these renters are better positioned to save for downpayments. Mortgage market innovations that allow borrowers to purchase with no savings may lower the bar to less flexible households, who are at greater risk in the face of price downturns or trigger events.

The results would also be consistent with a moral hazard problem. Borrowers may be more willing to undertake risky investments, such as buying from a developer without a track record, or purchasing a property in areas with high price volatility, if they are not investing any of their own funds. The evidence here is fairly indirect—borrowers with no cash invested have higher delinquency and claim rates, but nothing is known about prior earnings and saving behavior for these borrowers. Further research should be done along the lines of Boehm (1993), Krumm and Kelly (1989), Reid (2005), or Haurin, Wachter, and Hendershott (1995), to examine the earnings and savings histories of home buyers who make use of gift assistance, and determine the extent to which saving and earning flexibility may explain these higher claim rates.

Because of the prevalence of subprime refinancing over this time period, and the large numbers of mortgages from this sample that terminated in prepayment, the 15% to 20% claims to date found for gift downpayment mortgages in slowly appreciating MSAs are likely to be a lower bound estimate of the rate of "homeownership failure." These mortgages are at or just past their peak foreclosure years, and over 20% of these surviving loans have experienced at least one serious delinquency episode (over 25% for the surviving DAP loans). Some of these surviving loans may terminate in foreclosure in the future. Additionally, many of these no-cash-from-borrower mortgages may have terminated through a refinancing, with the new mortgage later terminating in a claim, as over half of these borrowers prepaid within four years. Some prepayments may also be from borrowers who exited homeownership but avoided an investment loss. This work may confirm the results of Reid (2005), who finds that many low to moderate income first time homebuyers transit back to rental status in the first five years.

This research does make clear that, for whatever reason, borrowers with no "skin in the game" have higher credit risk than comparable buyers who bring cash to the transaction. Designers of government assistance programs, mortgage insurers or other holders of credit risk, and planners concerned about pockets of foreclosure in neighborhoods should take these elevated risks into account.

## Endnotes

- <sup>1</sup> For a recent review of the literature on mortgage credit risk, see U.S. GAO (2005a).
- <sup>2</sup> While VA mortgages were available to qualified veterans with no downpayment, the VA does not allow closing costs to be financed. Seller-paid closing costs are limited, and sellers may be less able to “pass on” closing costs to borrowers, as the VA selects the appraiser used on a VA mortgage. Since 1995, it has been the case in the FHA program that the appraiser is selected by the lender, although the insurer (FHA) bears the credit risk. This may give rise to substantial incentive problems for FHA appraisals that are not present in the VA. Many VA borrowers would be required to make a cash contribution that would be categorized not as a downpayment, but as closing costs. See U.S. GAO (1996) for a detailed discussion of VA and FHA cash requirements.
- <sup>3</sup> At the time of writing, the status of these nonprofits is in doubt. The Housing and Economic Recovery Act of 2008 prohibits seller-funding as of October 2008, but legislation has been introduced to end the ban.
- <sup>4</sup> “3 percent downpayment” is the usual shorthand summary of FHA requirements. Technically, there is a fairly complex formula using the purchase price, closing costs, and the location of the loan in a high or low cost state that determines the required contribution from the borrower. But the result of the formula is a cash requirement between 2.75% and 3.5%. Although the FHA allows the financing of some closing costs, and allows limited direct closing cost assistance from sellers, borrowers (or approved sources such as relatives or nonprofits) are required to invest about 3% in cash. It is this 3% that FHA does not allow to come directly from the seller, but is allowed to come from a nonprofit funded by the seller.
- <sup>5</sup> The HUD OIG studies included reviews of paper files that found numerous instances of appraisal and sale prices scratched out, and new appraisal and sale prices, equal to the scratched-out price plus the amount of gift assistance, written over the old prices. The GAO study compared the ratio of sale price or appraisal to the results of an automated valuation model, and found that sales and appraisals averaged 3% higher for transactions with nonprofit gift assistance. It is doubtful that many sellers would participate in these programs if they did not receive higher sales prices as a result of their participation.
- <sup>6</sup> The GAO report includes a detailed discussion of the operation of seller-funded nonprofits.
- <sup>7</sup> The higher selling price would have to be ratified by a higher appraisal. As noted by both GAO and the HUD IG, increases in the appraised value were common for these loans.
- <sup>8</sup> See Concentrance Consulting Group (2004).
- <sup>9</sup> The other file was collected by HUD for the development of FHA’s automated underwriting algorithm. The years covered precede the proliferation of downpayment assistance programs. See Cotterman (2004).
- <sup>10</sup> In September 2005, the FHA imposed a moratorium on loan foreclosures for counties and parishes affected by hurricanes Katrina and Rita. Most of Louisiana, much of south Florida, Mississippi and Alabama, and the northeast corner of Texas were included. Loans in the affected counties or parishes that were still active are treated as censored in September 2005. This affected less than 1% of the national sample.
- <sup>11</sup> Underserved areas are defined in 24 CFR 81.2. They are tracts with very low median incomes, or low median incomes with high concentrations of minority residents.
- <sup>12</sup> Unemployment is not a stand-alone covariate, but is part of the *GAORisk* portmanteau variable.
- <sup>13</sup> The 2005 GAO report indicates a continuing growth in assistance post 2002. Incomplete data from the first half of FY 2005 indicated that seller-funded nonprofits were involved in 37% of FHA purchase endorsements with LTVs greater than 95% (FHA definition of LTV), and 55% of high LTV FHA purchase loans had assistance of some sort.

- <sup>14</sup> A non parametric baseline with competing risks and unobserved heterogeneity, as in McCall's program, has to be estimated with some care, as unreliable results may be obtained from singularities. See Ridder and Woutersen (2003).
- <sup>15</sup> About 8% of the borrowers did not have a FICO score. For these cases, the median FICO score for the sample was inserted, and a dummy variable (*NOFICO*) was set to 1. The coefficient shows the extent to which borrowers without a FICO score are riskier than borrowers with a median score. As the coefficient on *NOFICO* is often close to the *FICO* coefficient, but with an opposite sign, borrowers without FICO scores perform about the same as borrowers with FICOs 100 points below the median, since the *FICO* variable is scaled by 100.
- <sup>16</sup> The model, for GAO's fourth study of FHA actuarial soundness, is documented in U.S. GAO (2001).
- <sup>17</sup> These lags on house price appreciation and unemployment rates had been found to give the best fit in GAO work on FHA terminations.
- <sup>18</sup> The dependent variable indicates 90-day delinquency, or other "bad outcomes" such as the initiation of foreclosure or a loss mitigation foreclosure alternative. Although lenders are supposed to report delinquencies to FHA after 90 days, sometimes a delinquency is never reported but the loan appears as a claim or claim alternative. In 90% of the "delinquencies" in this file, the event is 90-day delinquency.
- <sup>19</sup> The percentage effects are calculated from the values of the estimated parameters, by exponentiating the coefficient, and subtracting 1 from the results.
- <sup>20</sup> Most conventional "100% LTV" products also require some cash from the borrower for closing costs.

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